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Armstrong's
EF - 26

Armstrong's
EF - 22

Armstrong's
N-25

Armstrong's

Armstrong's

INSULATING FIRE BRICK

for all types of heated equipment

Armstrong's
N-16

Armstrong's
N-20

FRANKLIN INSTITUTE
PHILADELPHIA

INSULATING FIRE BRICK

*cut fuel costs, speed production and
insure more accurate temperature control*

ESSENTIAL REQUIREMENTS OF EFFICIENT HIGH TEMPERATURE INSULATION

EFFICIENCY of high temperature insulation depends upon the following important factors:

1. **Thermal Conductivity**—The fundamental purpose of heat insulation is to reduce heat losses and, therefore, low thermal conductivity is one of the most important requirements of a heat insulating material.
2. **Physical Strength**—The insulation must be sufficiently strong to withstand the customary rough treatment in shipment and handling on the job without appreciable loss either by breaking or loss of corners. Installation of broken insulation results in not only increased labor costs but reduced efficiency. It is equally important that the physical strength of the insulation at the temperature used provides a margin of safety sufficient to withstand stresses that are due to direct loading or thermal expansion.
3. **Uniformity**—Accurate sizing of all standard brick and standard shapes insures tight joints if the insulation is laid dry or permits a much thinner joint if laid with cement. Constant manufacturing control is necessary to produce individual brick that are uniform in composition and structure.
4. **Refractoriness**—The insulation material must be manufactured of the proper clays to eliminate excessive shrinkage at the maximum recommended temperature; otherwise the overall heat transmission will be high and the strength of the complete structure will be impaired. At the same time it must also effectively resist spalling due to thermal shock. Different service requirements make it essential to have brick of different characteristics to give the best and most efficient service. Temperature alone is not the primary deciding factor.

EFFICIENCY OF ARMSTRONG'S INSULATING FIRE BRICK PROVED IN SERVICE

Armstrong's Insulating Fire Brick through years of satisfactory performance have proved that they meet all the essential requirements for efficient service—low thermal conductivity, high physical strength, uniformity in size and composition, low shrinkage and ample refractoriness for the use intended. Since 1914 Armstrong has pioneered improvements in Insulating Fire Brick and has been a leader in the manufacture of the insulating materials.

Armstrong's first Brick were originally designed for insulating purposes as a "backing-up" brick. Subsequent experiments and tests in actual service have not only improved the brick for this type of service, but have also developed the use of all of Armstrong's Insulating Fire Brick as refractory lining.

Actual service requirements have demonstrated that it is essential to have brick of varying characteristics to meet specific needs. As a result, Armstrong has developed five individual brick, making it possible to furnish brick especially suited for each required service. Insulating Fire Brick, as a rule, are not designed to resist slagging action or direct impingement of flame. Wherever these conditions cannot be avoided, surface coatings should be applied to the brick after installation.

Armstrong's Insulating Fire Brick are not suitable for installation in all places where fire brick are now used, but their acceptance and use is being constantly increased due to improved furnace design and methods of firing. These brick are equally serviceable for electrically heated, coal, oil, or gas fired equipment. For specific installations, an Armstrong representative should always be consulted for definite recommendations.

Each of Armstrong's Insulating Fire Brick is ideally adapted for the service recommended. Light in weight,



strong in structure, their insulating efficiency is materially increased by the fine cellular composition which is produced by burning out flaky ground rock. All bricks are made slightly convex and are cast through a lining machine which insures uniform strength across corners and edges generally stock to .001 of an inch. Armstrong's insulating results in not only a heat tight job but also a thermal saving in labor cost and increased construction strength.

Armstrong's Insulating Fire Brick properly used, combine the service secured from Fire Brick with the fuel saving obtained from Insulating Brick.

Armstrong's Insulating Fire Brick offers the following important advantages:

1. Maximum heat saving.
2. Thinner furnace walls and consequent larger hearth area.
3. High heat and fuel use and in the walls of the furnace providing uniform heat distribution.
4. Faster and more flexible temperature control with quicker heating and cooling.
5. More practical and efficient operation of intermittent type furnaces by decreasing the time required in bring the furnace up to operating temperature.
6. Less material used in construction of the furnace.
7. Lighter weight in overall construction of the furnace resulting in lighter steel construction.
8. New furnace designs which increase output per unit.

The extremely high crushing strength of all of Armstrong's Insulating Fire Brick makes them suitable for any type of design that may be developed without sacrificing thermal efficiency. Low conductivity has been the first consideration in the design and manufacture of Armstrong's entire line of Insulating Fire Brick.

Armstrong's Brick should not be used in applications where a heavy, lagging action is liable to take effect as in furnace linings or where there occurs the shock impingement of the flame. Armstrong's SF series brick have been designed for heavy duty where effectiveness is of more importance than other properties and should be used in preference to the other brick where this is the primary consideration. Experience shows that low heat performance by Armstrong in stocking the SF series as well as moderate lightweight in weight secure additional effectiveness and maximum high thermal efficiency.

The Armstrong's Insulating materials described in this folder are fully qualified by leading furnace builders and plant engineers because experience has demonstrated that Armstrong's materials can be depended upon for consistent and successful results.

ARMSTRONG'S V-20 BRICK

Armstrong's V-20 Brick was formerly known as "Vee-gard" and was one of the first insulating brick to be commercially available in the United States. This brick serves very efficiently both as a backing-up brick and as an Insulating Fire Brick where the hot face temperature does not exceed 1400 degrees F. In general use, however, it is usually installed as a backing-up brick.

The use of this brick results in a saving of from 10% to 20% of the heat loss by conduction and radiation through an uninsulated construction and it is exceptionally efficient. The weight of a single (7 1/2" x 2 1/2" x 3 1/2") brick is 12 pounds. Its cold crushing strength is 200 pounds per sq. in.

ARMSTRONG'S V-20 BRICK

Armstrong's V-20 Brick is especially suitable for furnace and equipment operating at moderate temperatures where the temperature on the hot face of the insulating



is not in excess of 2000 degrees F. The weight of a straight ($9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ ") is 2.1 pounds and the cold crushing strength is 300 pounds per sq. in.

ARMSTRONG'S A-25 BRICK

Armstrong's A-25 Brick was formerly known as Armstrong's Brick. It does not crack, fuse, or spall under temperatures as high as 2500 degrees behind the refractory and it is used directly exposed in a great many instances. It serves as a refractory lining where heavy duty is not required, but is most generally used as backing-up brick. The weight of a straight ($9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ ") brick is 2.2 pounds and its crushing strength is 225 pounds per sq. in.

ARMSTRONG'S EF-22 BRICK

Armstrong's EF-22 Brick was primarily designed for heavy duty in direct exposure up to 2200 degrees F., and is adaptable to practically any type of exposed service. It is a straight ($9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ ") brick and weighs 2.75 pounds. Its crushing strength is 340 pounds per sq. in.

ARMSTRONG'S EF-26 BRICK

Armstrong's EF-26 Brick is a heavy duty Insulating Fire Brick that can be used in practically any service up to a hot face temperature of 2600 degrees F. A straight ($9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ ") brick weighs 2.75 pounds and has a cold crushing strength of 450 pounds per sq. in.

SPECIAL SHAPES

Due to the ever increasing demand for special shapes made to customers' specifications as to size, Armstrong has established a plant department for the sole purpose of manufacturing custom built shapes. Special shapes are made to match each of the five types of brick which Armstrong manufactures and are of two distinct classes—machined to size and molded to size.

The machined-to-size pieces are of the same conductivity as the standard brick and standard shapes and are produced by accurately machining large size pieces of rough stock to the dimensions required. Pieces produced by this method of manufacture are machined to an accuracy of .004 of an inch on all dimensions.

Molded-to-size special shapes are slightly heavier than standard stock material and are produced by molding and firing to the shape desired with a tolerance of $\frac{1}{16}$ ". Tolerances in size permit a variation from specified dimensions covering both warpage and shrinkage of plus or minus 3% for dimensions under 4" and plus or minus 2% for dimensions over 4".

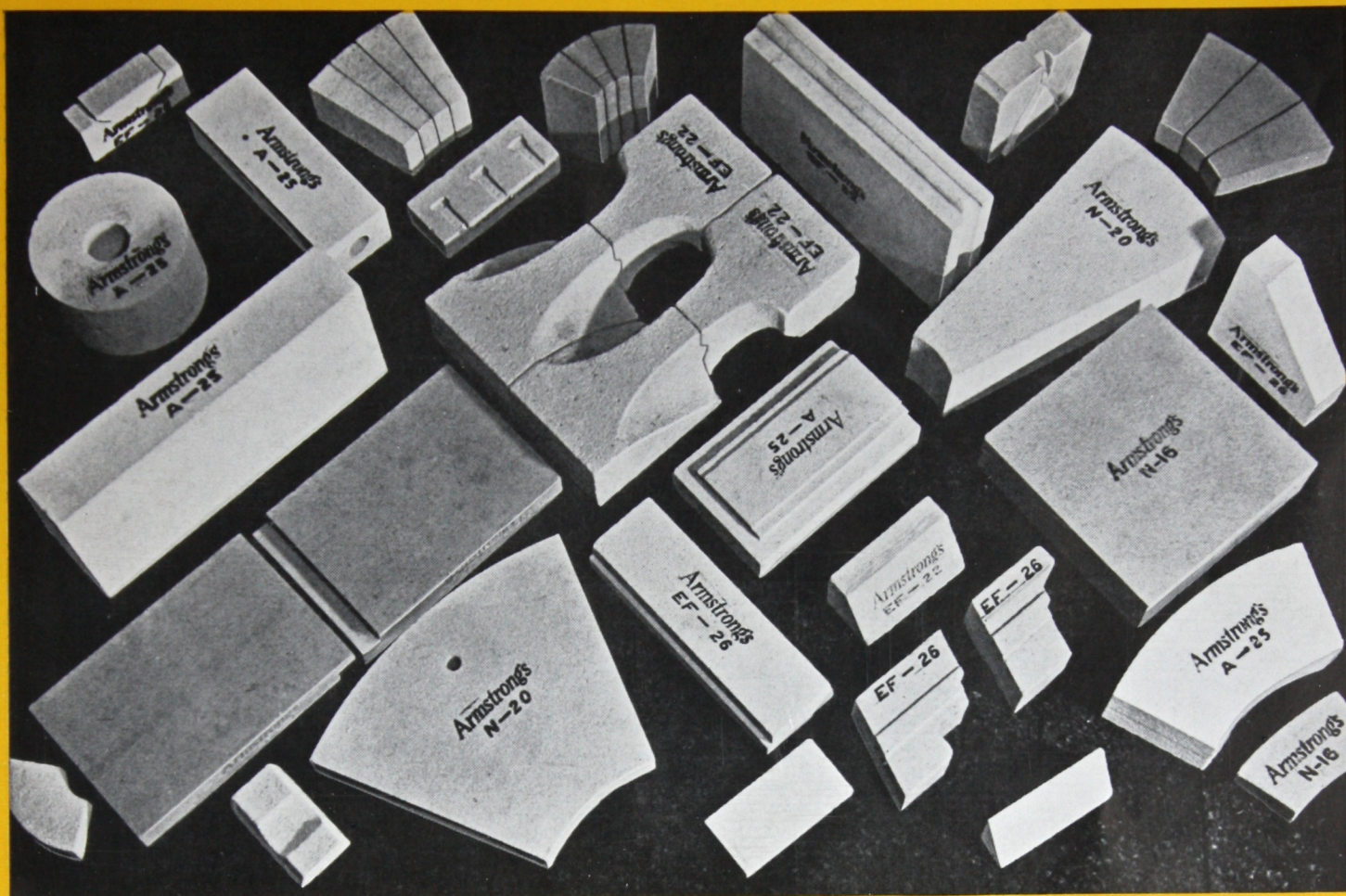
The handling of these special shapes in a separate department makes it possible to get a much better finished product and to speed delivery to customers.

DESIGNATION AND TERMINOLOGY OF ARMSTRONG'S BRICK

The proper nomenclature to be used in describing the different products manufactured by Armstrong in the Insulating Fire Brick line is as follows:

1. "Standard Brick"—This term indicates the following specific sizes:

Straights	($9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ ") or ($9 \times 4\frac{1}{2} \times 3$ ")
Splits	($9 \times 4\frac{1}{2} \times 1\frac{1}{4}$ ") or ($9 \times 4\frac{1}{2} \times 1\frac{1}{2}$ ")
Soaps	($9 \times 2\frac{1}{2} \times 2\frac{1}{4}$ ") or ($9 \times 3 \times 2\frac{1}{4}$ ")
2" Brick	($9 \times 4\frac{1}{2} \times 2$ ")
2. "Standard Shapes"—All other types of brick which appear on the regular price lists including the different Wedge, Key, Arch, Neck, Skew, Feather Edge, Circle and No. 105 Slotted Arch Type, both



4½ and 9" way, in both the 2½ x 3" series are properly termed "Standard Shapes."

3. "Special Shapes"—All other brick forms not outlined above are properly termed "Special Shapes" and must be further identified by one of the two following designations:

- a. "Machined to Size"—(produced by using large size rough stock and machining to size with a .004" tolerance).
- b. "Molded to Size"—(produced by molding to size with a Standard Fire Brick tolerance. These pieces are molded, fired, and shipped without any type of machining).

NOTE: When specifying any brick size always start with the largest dimension followed progressively by descending dimensions. (Example: 9 x 4½ x 2½".)

SPECIAL TECHNICAL SERVICE

Armstrong maintains a group of qualified High Temperature engineers in leading industrial sections of the country who are thoroughly experienced in all types of design where high temperature insulation is required. These engineers will be glad to assist you in the selection of the proper materials to be used and to recommend its proper application. This service is without obligation or

charge and can be secured by communicating with Armstrong's nearest district office or representative as listed on the last page of this booklet.

The Armstrong Central Technical Laboratories are also available for research on unusual problems.

For engineers wishing to make an open specification for high temperature insulation, Armstrong will be pleased to furnish upon request a complete specification outlining the standards required for the different physical characteristics with permissible tolerances.

OTHER ARMSTRONG INSULATING MATERIALS

In addition to Armstrong's Insulating Fire Brick, these other products of the same Armstrong high quality and efficiency are offered:

ARMSTRONG'S HIGH TEMPERATURE BLOCK is a superior insulating material in block form. Detailed information concerning the temperature limits, conductivity, and other physical characteristics will be furnished upon request. These blocks can be furnished in thicknesses of 1", 1½", 2" or 3" and in sizes up to 12 x 36".

ARMSTRONG'S CEMENTS

Although all Armstrong's Insulating Fire Brick can be laid up dry, a complete line of cements for laying and fac-

TABLE SHOWING CHIEF CHARACTERISTICS OF ARMSTRONG'S INSULATING FIRE BRICK

BRAND OF BRICKS	LIGHT DUTY			HEAVY DUTY	
	Armstrong's N-16	Armstrong's N-20	Armstrong's A-25	Armstrong's EF-22	Armstrong's EF-26
Temperature Limits	1600° F. on Hot Face of Brick	2000° F. on Hot Face of Brick	2500° F. on Hot Face of Brick	2200° F. on Hot Face of Brick	2600° F. on Hot Face of Brick
Crushing Strength (Cold)	205 Lbs. per Sq. In.	280 Lbs. per Sq. In.	260 Lbs. per Sq. In.	430 Lbs. per Sq. In.	450 Lbs. per Sq. In.
Weight—Standard Straight Brick	1.8 Lbs. Each	1.9 Lbs. Each	2.2 Lbs. Each	2.75 Lbs. Each	2.75 Lbs. Each
Shapes	All standard brick and standard shapes of N-16, N-20, A-25, EF-22, and EF-26 Brick in stock; machined accurately to size with .004" tolerance. Stocks carried at the factory and branch warehouses. Special shapes molded or machined to size, manufactured to specifications.				

TABLE SHOWING CHIEF CHARACTERISTICS OF ARMSTRONG'S CEMENTS

	ARMSTRONG'S No. 1600 CEMENT	ARMSTRONG'S No. 2500 CEMENT	ARMSTRONG'S No. 2600 CEMENT	ARMSTRONG'S AIR SET CEMENT	ARMSTRONG'S FACING CEMENT (Sillimanite)	ARMSTRONG'S MONOLITHIC CEMENT
Cement Used for	Laying N-16 Brick.	Laying N-20 and A-25 Brick.	Laying and facing EF Type Insulating Fire Brick.	Laying and facing all brands where a strong bond is de- sired.	As a facing for tem- peratures of 2500° F. and over. Rarely used for bonding.	1. As a fill between steel shell and brick work. 2. As insulation troweled in place. 3. As a monolithic coating on block or blankets.
Packed in	Burlap Bags of 100 Lbs. Net.	Burlap Bags of 100 Lbs. Net.	Burlap Bags of 100 Lbs. Net.	16, 50, 95, 190-Lb. Net Steel Drums.	20, 50, 100, 200, 300-Lb. Net Steel Drums.	Burlap Bags of 50 or 100 Lbs. Net.
Weight per Cu. Ft. as Shipped—Lbs.	50 Lbs.	62 Lbs.	68 Lbs.	110 Lbs.	120 Lbs.	34.5 Lbs.
Amount of Water Needed for Dip Joint Con- sistency Gals. per 100 Lbs. Cement	9 Gals.	6 Gals.	5½ Gals.	1¼ Gals.	1 Gal.	ADDITIONAL INFORMATION Covering Capacity 270 Lbs. per 100 Bd. Ft. Water Required 20 Gals. per 100 Lbs. of Dry Cement. Caution: Should be used within 4 hrs. after mixing. Drying Shrinkage 2.9% of original length. Firing Shrinkage 2.63% of dry di- mension after 3 hrs. at 1500° F.
Amount of Water Needed for Brushing Con- sistency Gals. per 100 Lbs. Cement	.....	.....	6½ Gals.	2¼ Gals.	1¾ Gals.	
Pounds of Cement Required for Dip Joints per Thousand Brick, Bonded	N-16 N-20 A-25 EF-22 EF-26	150 Lbs. 200 Lbs. 150 Lbs. .....	..... ..... ..... 200 Lbs. 200 Lbs.	..... ..... 300 Lbs. 250 Lbs. 250 Lbs. 300 Lbs. 300 Lbs.	..... ..... ..... ..... ..... 300 Lbs.	
Pounds of Cement Required for Double Brush Coating One Square Foot of Armstrong's Brick.	N-16 N-20 A-25 EF-22 EF-26	..... ..... ..... ..... .....	..... ..... ..... ..... .....	..... 0.35 Lb. 0.35 Lb. 0.35 Lb. 0.35 Lb. 0.35 Lb.	..... 0.5 Lb. 0.5 Lb. 0.5 Lb. 0.5 Lb. 0.5 Lb.	..... 0.5 Lb. 0.5 Lb. 0.5 Lb. 0.5 Lb. 0.5 Lb.

ing the brick are manufactured. A table giving the characteristics and amounts required is illustrated above. A special booklet on cements has been prepared and will be furnished to you upon request.

ARMSTRONG'S MONOLITHIC CEMENT

Armstrong's Monolithic Cement is a cement manufactured for use as an exterior coating for furnace walls or structural equipment. It may also be used as a filler between the furnace walls and steel jacket or in confined spaces. Physical characteristics of this cement are given in the table reproduced above.

ARMSTRONG-CORNING WOOL

Armstrong-Corning Wool is a mineral, fibrous material furnished in bats, metal mesh blankets, rolls, or tufted.

OTHER ARMSTRONG INSULATION AND BUILDING PRODUCTS

ARMSTRONG'S HIGH TEMPERATURE BLOCK. For all types of heated equipment.

ARMSTRONG'S CORKBOARD for insulating cold storage rooms, walls and roofs of commercial and public buildings and residences, refrigerator cars, commercial display cases, refrigerators, tank cars, and trucks.

ARMSTRONG'S CORKOUSTIC for noise-quieting and acoustical correction.

ARMSTRONG'S CORK COVERING for refrigerated drinking water systems, brine, ammonia, and all cold lines.

This efficient material can be used in all types of heated equipment provided the temperature on the hot face of the insulation does not exceed 900 degrees F.

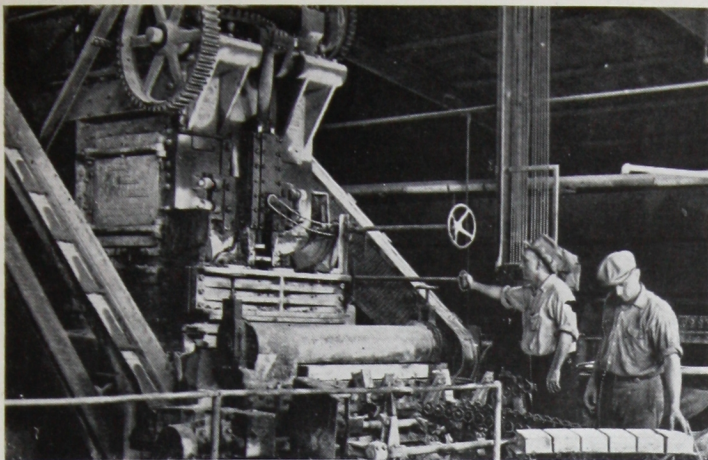
DIATOMACEOUS EARTH

Armstrong's Diatomaceous Earth can be furnished for insulating purposes either in the raw state (powdered or coarse) or calcined. It is calcined at temperatures in excess of 2000 degrees F.

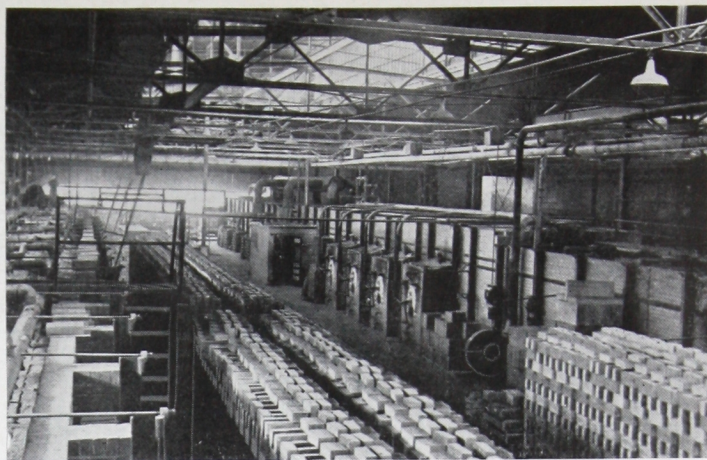
The weight packed dry is 27 pounds per cu. ft.

PRICE LISTS AND SAMPLES

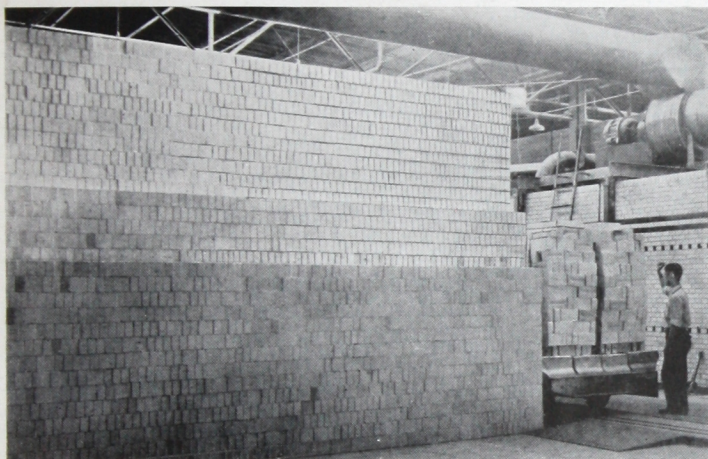
For further details, complete information, price lists, and samples, contact the nearest Armstrong district office or write directly to Armstrong Cork Products Company, Building Materials Division, Lancaster, Pa.



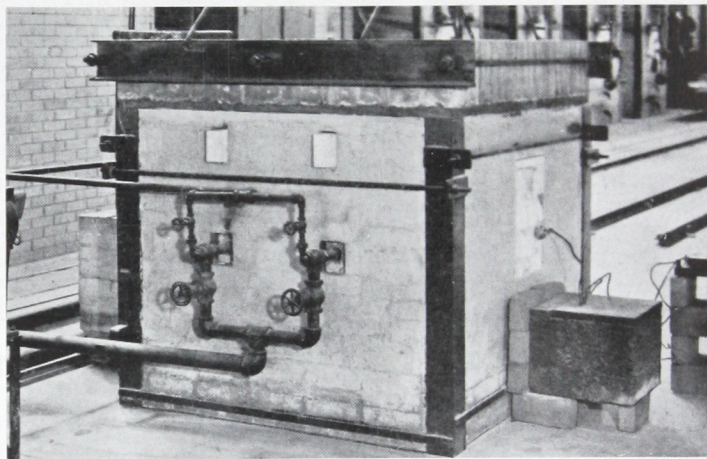
Giant Press used for molding all types of insulating brick made by Armstrong. The accurate control mechanism assures correct pressures and press speeds. Automatic conveyors carry the brick directly to the dryers.



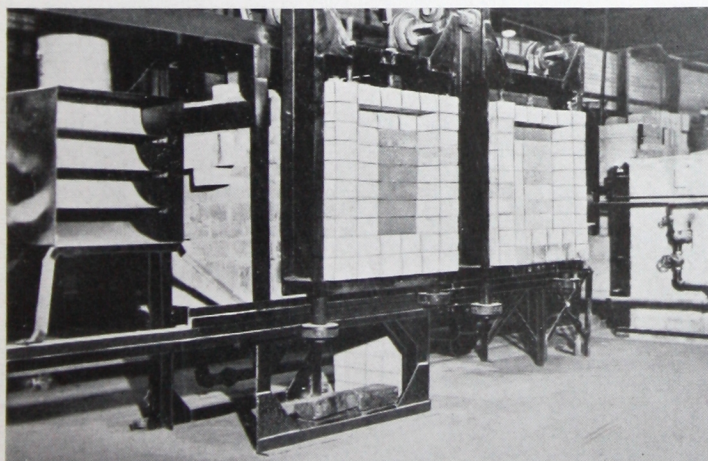
A Tunnel Kiln specially designed for firing Armstrong's Insulating Brick. Exact temperatures are controlled by a recording potentiometer system and additionally checked with pyrometric cones on each kiln car.



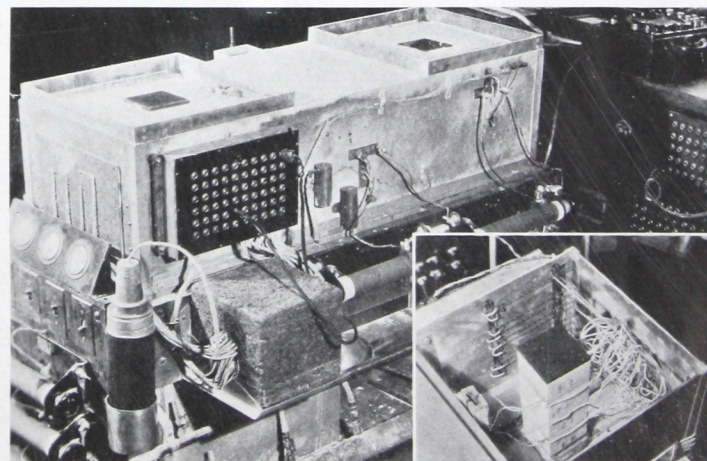
Accurate sizing insures tight joints which give operating efficiency. Note the even set-offs in this pile of insulating brick at the Armstrong factory. The bricks as they come from the kiln are shown on the extreme right.



Test Kiln (for temperatures from 1000° to 3000° F.) at the Armstrong factory, Beaver Falls, Pa. Here experiments are conducted with different mixes, temperatures, and burning periods.



Spalling Test Furnace used to test insulating brick under U. S. Navy specifications for spalling test. Bricks in panel forms are alternately heated in the furnace and cooled by air blast.



Heat Flow Test Equipment in Central Technical, Laboratory, Lancaster, Pa. Inset—Close-up of heat flow testing equipment showing samples in position and thermocouple leads.

ARMSTRONG CORK PRODUCTS CO.

Building Materials Division

L A N C A S T E R , P E N N S Y L V A N I A



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